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(54) **METHODS, SYSTEMS, AND APPARATUSES FOR QUANTITATIVE ANALYSIS OF HETEROGENEOUS BIOMARKER DISTRIBUTION**

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(57) **ABSTRACT**

Methods, systems, and apparatuses for detecting and describing heterogeneity in a cell sample are disclosed herein. A plurality of fields of view (FOV) are generated for one or more areas of interest (AOI) within an image of the cell sample are generated. Hyperspectral or multispectral data from each FOV is organized into an image stack containing one or more z-layers, with each z-layer containing intensity data for a single marker at each pixel in the FOV. A cluster analysis is applied to the image stacks, wherein the clustering algorithm groups pixels having a similar ratio of detectable marker intensity across layers of the z-axis, thereby generating a plurality of clusters having similar expression patterns.